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DIRECTORATE OF
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Intelligence Memorandum

The French Space Program: Profile of an Independent Effort

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CENTRAL INTELLIGENCE AGENCY
Directorate of Intelligence
30 November 1971

INTELLIGENCE MEMORANDUM

The French Space Program: Profile of an
Independent Effort

Summary

In 1962, France formally embarked on an ambitious effort to establish itself as a power in the field of space. After almost ten years, during which time they have spent the equivalent of about \$1 billion, the French have made a more extensive commitment in the field of space than any country in the world other than the US and USSR. France is the only country in Western Europe with an independent capability in both space research and applications. It has developed its own launchers, launch complex, research centers, laboratories, and tracking and data processing facilities.

The French have built several types of space boosters, the latest being the Diamant B. When a few minor problems are solved, the Diamant B probably will be a reliable and accurate launch vehicle. It will be close enough in performance to the improved US Scout to be competitive, although it will be somewhat more expensive.

The new space launch complex constructed in French Guiana at a cost equivalent to more than \$100 million is now operational.

Note: This memorandum was prepared by the Office of Strategic Research and coordinated within CIA.

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In addition to the launcher development programs and the construction of a modern well-equipped space launch center, the French also have established at least five major space research, development, and test facilities in France. The newest of these is located at Toulouse where the government, at a cost equal to some \$110 million, has built a university and developed an industrial complex specifically oriented toward aerospace activities.

France's expenditure on space activities in recent years has amounted to more than one-third of the total for Western Europe as a whole, and this proportion is growing as the French increase and most other Western Europeans cut back spending in this field. France also is the only Western European country to spend consistently more on national and bilateral space projects than it contributes to Europe's multinational space programs.

French bilateral cooperative efforts have recently been undertaken largely with West Germany, the only other European country willing to support large space programs. Cooperation between Paris and Washington has been reasonably constant, although not extensive, over the past several years, but is likely to accelerate should the US alter its policy and indicate a willingness to provide space launch vehicles to France or Europe without restrictions on their use. Franco-Soviet space cooperation formally began in 1966 amid rhetoric of great things to come. Since then, however, cooperation between Paris and Moscow has been maintained at a rather modest level.

A major portion of the French efforts to develop large space boosters has been channeled through the European Launcher Development Organization (ELDO), which is presently focusing on development of the Europa II and the Europa IIIB. Paris acknowledges that the development of the Europa IIIB will take a

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long time, but believes that need outweighs other considerations if Europe is to have the hardware necessary to launch heavy satellites in the future.

The European cooperative space programs have been plagued since their inception in the early Sixties by problems of coordination and financing and by a lack of commonly shared priorities. France's decision to establish its own independent capabilities in the field of space has both contributed to and compensated for Europe's disarray.

The French have varied and complex reasons for large expenditures on the "luxury" of space programs. They view their space activities as having provided invaluable inputs to a whole range of scientific, aerospace, and military programs, as well as having helped place France in the forefront of the European scientific community. Paris has maintained for some years that France and the other Western European countries share common interests in the field of space and the technical capacity to undertake programs to support those interests. Of no small import in French calculations, however, has been the contribution to the nation's prestige in the world community which a large space program makes. Paris continues to consider space to be one of the important fields of participation, befitting a wealthy country in a position of world leadership.

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Major French Space Programs

Background

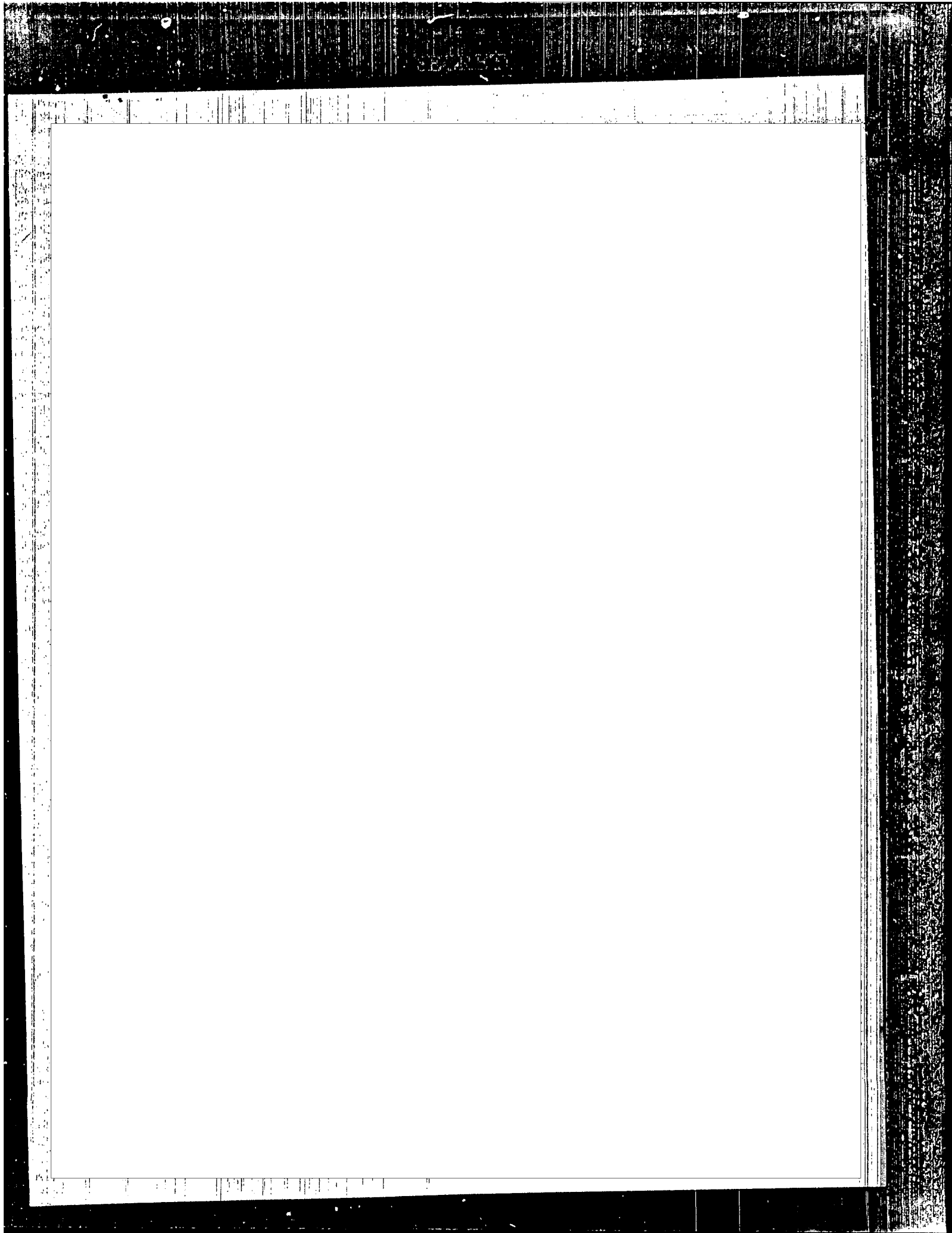
In the early Sixties most Western European countries were not interested in spending large sums of money to develop national or European space programs. France, however, was unwilling to leave the field completely to the US and USSR, and it formally began its own space efforts in late 1961 by creating the National Center for Space Studies (CNES).^{*} Its purpose was to define national space policies and execute French space programs. This agency, a government organization having industrial and commercial affiliations, began operations in March 1962.

The French defined a national space effort encompassing both developmental and applications programs. The developmental aspects have involved primarily production of launchers, sounding rockets, balloons, and related facilities. The applications program is centered around four major areas which the French believe yield the greatest and most fruitful substantive return for a given amount of resources invested: satellite communications, meteorology, exploration of potential natural resources, and air and sea traffic control. Of these applications, communications has the greatest importance and highest priority in the immediate future.

By the end of 1966 CNES had resolved many of the major hurdles which it faced five years earlier when it was created. It had developed a reliable launch vehicle and launched a satellite, built laboratories and technical centers, begun construction on a new launch complex in South America, and established France as an important, if not essential, partner with other European countries in cooperative space programs.

^{*} Centre National d'Etudes Spatiales

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Development of Space Launch Vehicles

Like the US and the Soviet Union, France began work in 1945 on missile development under the tutelage of German rocket experts. Early efforts culminated in the development of France's first rocket, the Veronique, which is still in use as a high-altitude research rocket.

To facilitate these early efforts the French Government began in 1946 construction of a rocket experimentation test center at Vernon (the Laboratories for Ballistic and Aerodynamic Research*), just north of Paris (see map opposite). It was expanded during the Fifties and became the principal French facility for static testing of rocket engines and missile stages. Significant construction and expansion were again undertaken there in the early Sixties as a result of France's increased commitment to space activities.

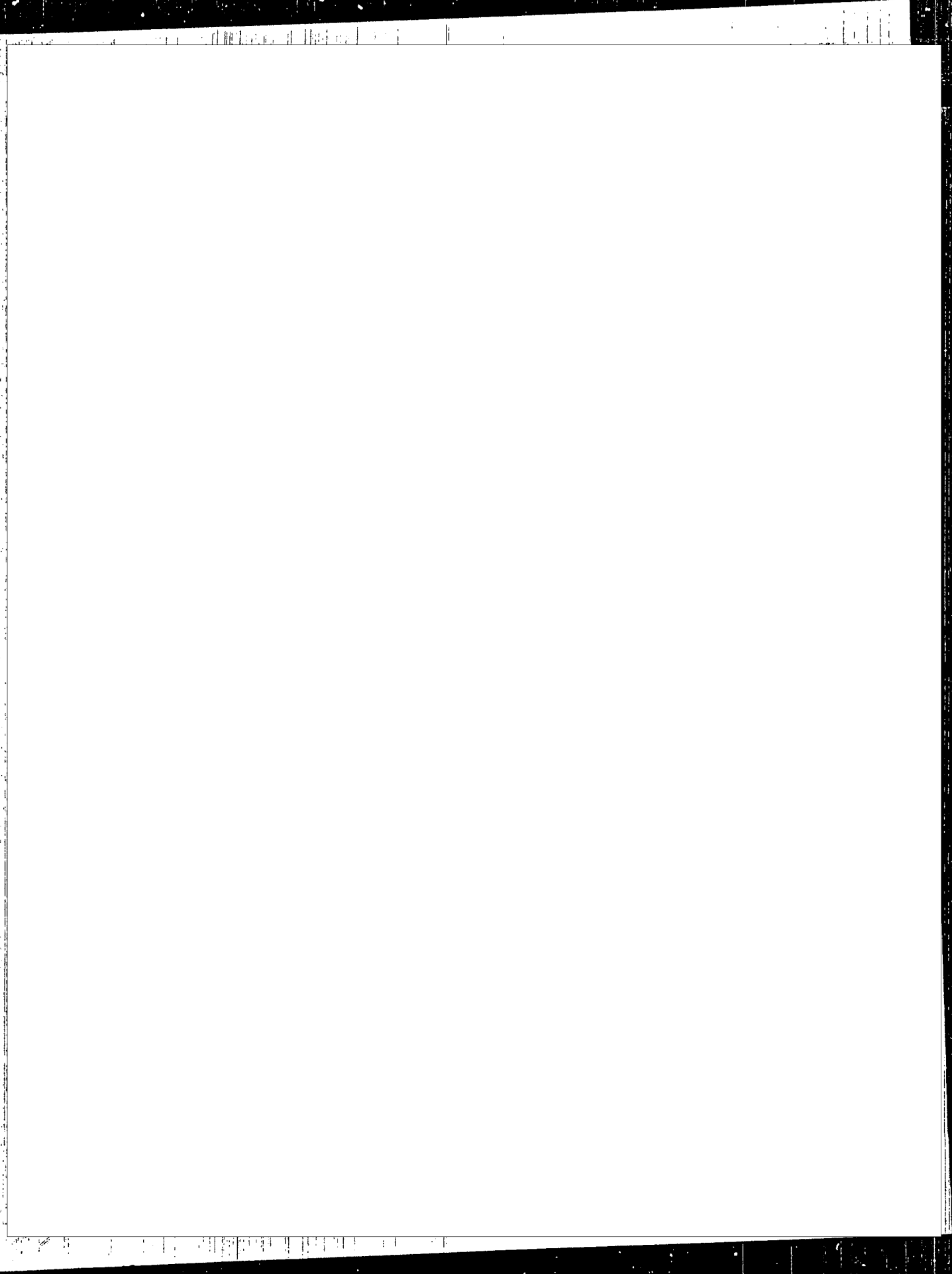
The Vernon center now has four vertical test stands, facilities for aerodynamic research and testing, laboratories for space environmental inertial navigation research, shop facilities for production of prototypes of rocket engine systems using liquid propellants, and a facility for testing toxic propellants. To further enhance their capabilities in the field of liquid propellants, the French in the early Fifties built another major center for development and testing of liquid-propellant rocket engines at Villaroche.

In 1958, the French decided to develop solid-propellant motors as well. Major research, development, and test facilities for solid propellants were built at Bordeaux, and a solid-propellant rocket motor testing facility was constructed at Istres.

* *Laboratoire de Recherches Balistiques et Aerodynamiques de Vernon*

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By the 1960-1963 period, the Ballistic Missile Research and Development Organization,* a consortium of private and governmental aerospace firms, was ready to begin building France's more advanced boosters. From these efforts evolved a series of space launch vehicles, some of which were precursors of France's strategic ballistic missiles. In this portion of the launch vehicle program, the French demonstrated an interesting technique. They developed a series of single-stage units--principally the Agate, Emeraude, Topaze, and Amethyste--which were used in varying combinations, both liquid and solid, as sections of multistage systems to create new launch vehicles (see illustration opposite).

Development of a launch vehicle for orbiting French satellites was financed by CNES but directed by a military organization called the Ministerial Delegation for Armament (DMA).** The goal was to turn the Saphir, a two-stage experimental ballistic missile, into a three-stage space booster.

In November 1965, just three and a half years after the cooperative effort between CNES and the DMA began, France orbited its first satellite, the Asterix, using the Diamant A--France's first propulsion system for orbiting satellites. The satellite was put into orbit from the French launch complex at Hammaguir in western Algeria. France's second satellite was launched in December 1965 from Vandenberg, California, using the US Scout launch vehicle. Three subsequent French satellites were launched from the facilities in Algeria, using the Diamant A space booster. The last of these five satellites was put into orbit in February 1967.

A three-year hiatus in satellite launch operations followed, partly because France withdrew from

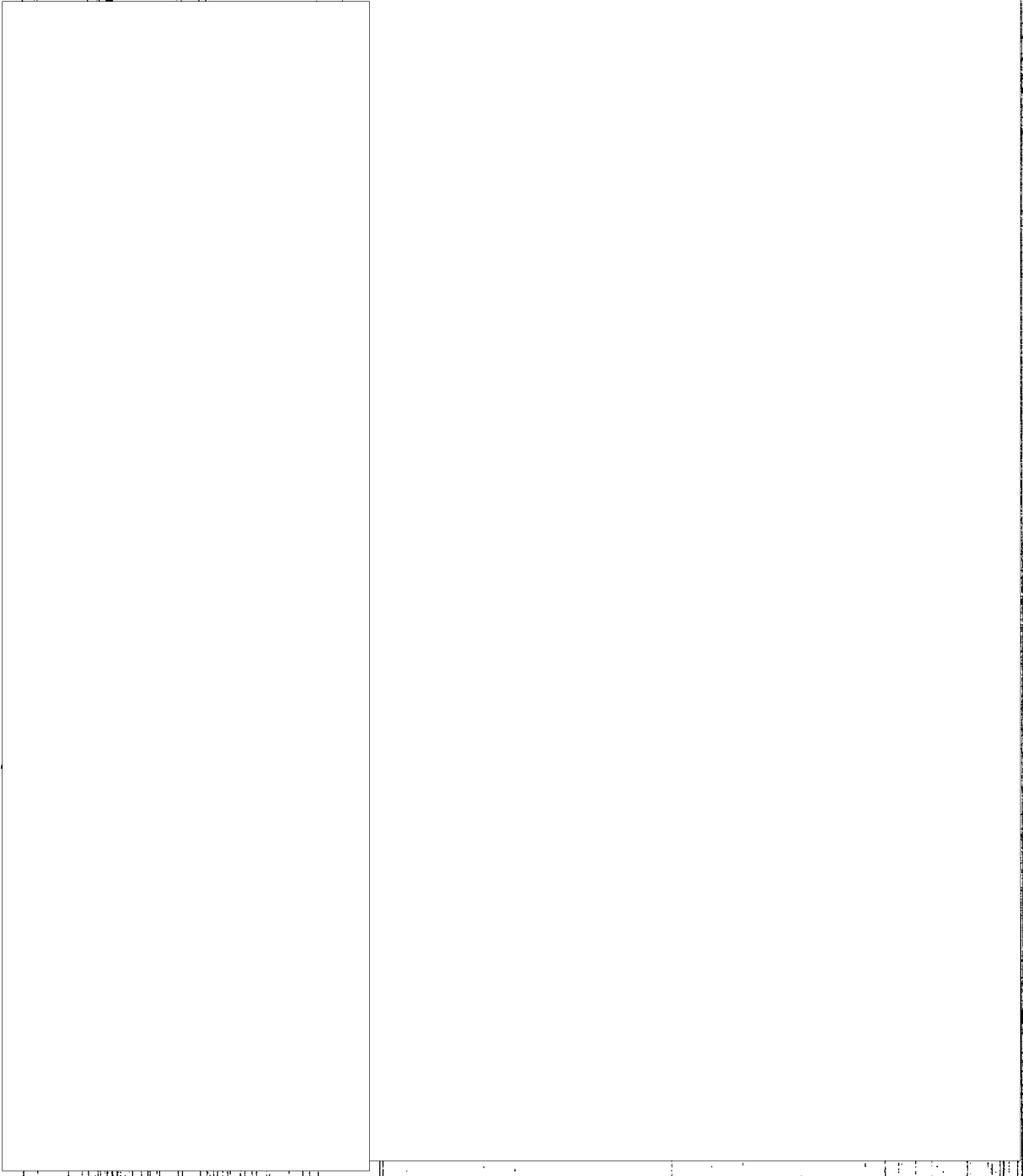
* *Societe pour l'Etude et la Realisation d'Engins Balistiques*

** *Delegation Ministerielle pour l'Armement*

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Algeria and had to give up its facilities there, but also because a more powerful launch vehicle--the Diamant B--was being developed to handle heavier payloads. CNES resumed launch operations in March 1970 from its new space complex in French Guiana, when a Franco-German scientific satellite was placed in orbit



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France has offered to make its Diamant B, or any new launch vehicles it develops, available to the Western European scientific community on a fee basis. In addition to providing some of the necessary hardware which the French hope will keep other European countries involved in space activities, this program also will help France amortize its investments in launch vehicle development.

A New Launch Complex

An integral part of the first concern of CNES--developing a launch vehicle--was the building of a launch complex. Such a facility was considered essential to France's plan for establishing a strong, independent capability in the field of space.

When the French Government granted independence to Algeria in 1962, it also recognized that it would one day have to abandon its launch facilities there.

In 1964, long before actually leaving Algeria, the French Government chose a site in French Guiana, along the northern coast of South America. This area was considered ideal, primarily because of its equatorial location, which permits heavier payloads

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to be orbited for a given amount of thrust and allows direct insertion into equatorial orbit without orbital changes. Moreover, the location of the rangehead on territory politically controlled by France was considered essential for such a costly investment. Finally, the Guiana site obviated any hazard of booster impact on populated land areas and provided an overwater firing range of some 4,000 nm. (See map on page 12.)

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The French Government has offered to make its space facilities available to all interested countries. Those countries choosing to use the center in French Guiana unilaterally would be charged a fee, but apparently such a fee would be waived if the complex were used for a cooperative space venture with France. Paris is seeking paying customers for the space facility to help amortize its large capital investment in the complex. Although foreign scientists are prohibited from staying at the center permanently or for "long periods of time," exceptions would be granted should the facilities be used by either the US or USSR during manned space flights.

The US has shown serious interest in the French Guiana Space Center. A technical survey team from the US National Aeronautics and Space Administration (NASA) visited the center in late October 1969 and described it as "a first-rate facility--versatile, well-planned, and modernly equipped--manned by highly capable personnel."

A year after the NASA visit, the US and French national space agencies jointly announced a cooperative meteorological program which calls for the launching of US and French sounding rockets from the Guiana center. The initial five launches in this series--the first involving non-French use of the space center--occurred in early March 1971.

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The National Center for Space Studies
Finds a Home

Simultaneously with the space launch vehicle and launch complex programs, the French National Center for Space Studies (CNES) was wrestling with decisions about space laboratories and the physical location of the agency's various facilities.

In its desire to create facilities and programs necessary to the French space effort as quickly as possible, CNES built space laboratories and a technical center on a site belonging to the French Army at Bretigny near Paris in the early Sixties. While it was possible to provide the necessary installations on this site quickly, there was no room available for future expansion.

In 1966, the government decided that CNES would soon need a more modern and larger main space facility and that it should be located at Toulouse, in southern France (see the map on page 6). In 1968 the space agency began to move from the facilities at Bretigny to the new complex. It has not abandoned Bretigny entirely, however, and will soon shift its headquarters, now located in Paris, to that location. As of late 1970, the government had spent the equivalent of some \$110 million to create a large modern university and industrial complex in Toulouse specifically oriented toward aerospace activities. When the move to Toulouse is complete--probably in the next few months--there will be about 700 space agency personnel at the new 420-acre complex. About 100 temporary employees will be added in peak periods--during preparation of a satellite, for example.

The Toulouse center* has essentially four sectors of activity: satellites, sounding rockets, balloons, and environmental testing. The most impressive of the test facilities is the new space

* *Centre Spatial de Toulouse du CNES*

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simulator, the largest in Europe. Static missile test-firing, aerodynamic research, and guidance system evaluation work will continue to take place at the Vernon guided missile and rocket experimentation test center.

The Military Services and the French Space Effort

France's space program, like that of the United States, is a civilian undertaking with considerable military support. Military involvement is handled by the Ministerial Delegation for Armament (DMA), which is directly under the Defense Ministry.

The French armed forces have provided indispensable technical and logistic support to CNES, as well as some financial help. Launch vehicle development, for example, has been financed largely by the space agency but directed by the military through the DMA. The armed forces in return have obtained scientific and technical benefits from participation in space activities of CNES, such as communications satellites and atmospheric studies.

The French Government continues to hold the view that the fruits of many of the present civilian space

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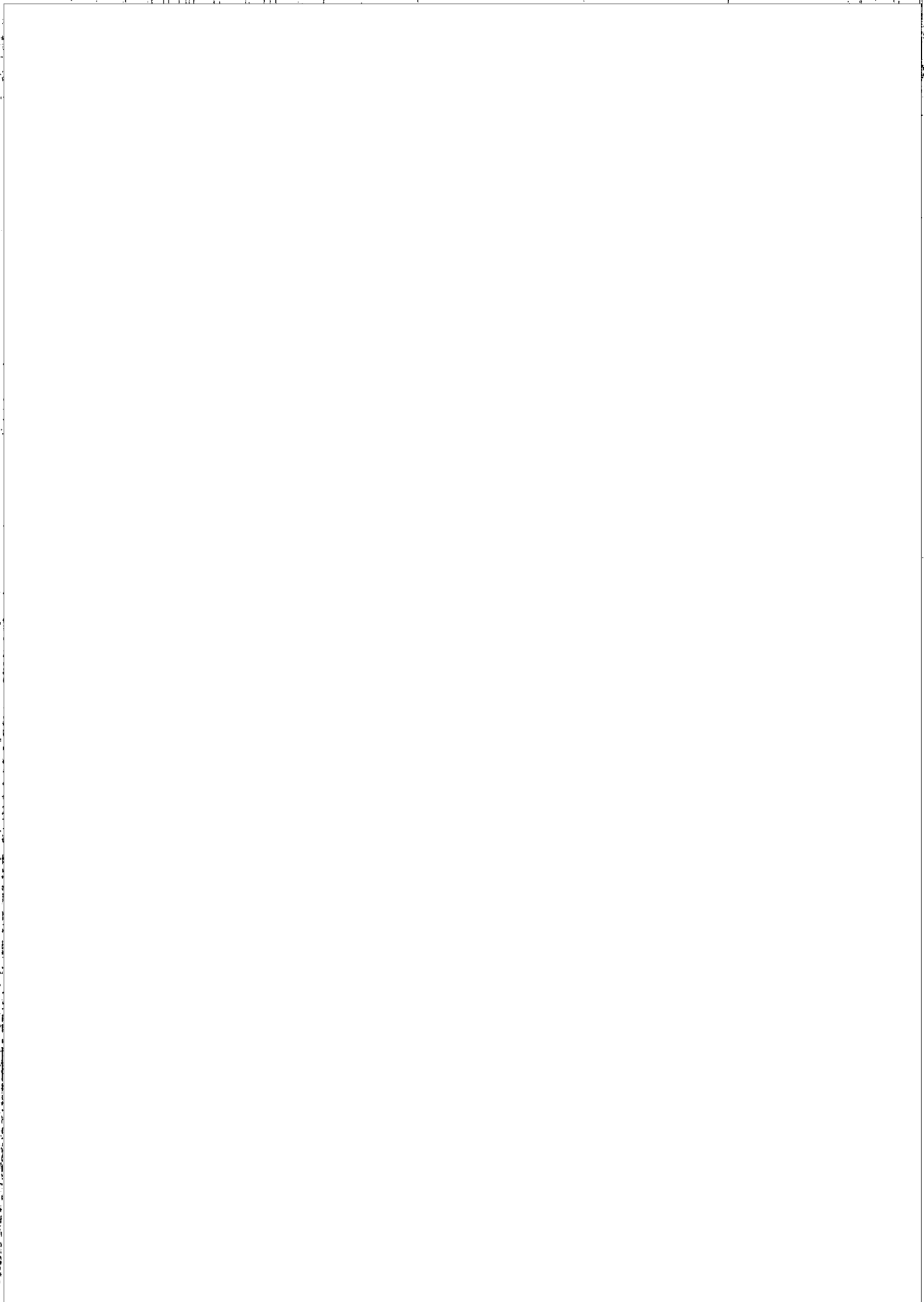
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programs can be applied to enough of the military programs to obviate the need for a separate, large-scale military space effort. This view seems to have been accepted by the French armed forces.

French Bilateral Cooperation

In the early Sixties, the French anticipated leading the countries of Europe into significant joint participation in space programs with both the US and USSR. They now, however, are having to argue forcefully to keep most of the other Western European countries from abandoning space endeavors completely or simply becoming subservient to US programs. As a result, France has decided to seek unilateral cooperative arrangements with the US and the Soviet Union as well as with individual European countries.

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With the United States

France and the US have maintained a cooperative relationship over the past several years which promises to continue. The US has launched two French satellites, the most recent a weather satellite on 16 August 1971, and Paris has cooperated with the US space agency on several space projects.

France, among several other European countries, has been invited to join the US in its post-Apollo manned-space project--the shuttle and space station program. The French have expressed a willingness to participate and pay some portion of the costs, but only to the extent that such costs do not impinge on their own space programs. They question, however, whether there will even be a post-Apollo program, inasmuch as US funding has not been guaranteed.

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In any case, France has frequently pointed out it is more interested in communications and scientific satellites than in expensive manned projects. The French say they would much prefer to see the Americans limit their cooperative space efforts with Europe to less showy and expensive projects.

One such effort is a joint French-US project involving the use of a meteorological satellite and balloons to track global winds. Balloons were launched in late 1971 in conjunction with the satellite launched on 16 August as part of the feasibility test. This project also has led to discussions of cooperation in an advanced synchronous weather satellite project.

The US resumed rocket launchings at the new French Guiana Space Center last September under a US-French cooperative meteorological program. Seventeen US Nike and French Centaure sounding rockets were launched under this program, the first five in early March 1971.

Cooperation between France and the US in space probably will continue at a modest level. It could increase somewhat, however, should the US alter its policy and provide space launch vehicles to France or the other countries of Western Europe without restrictions on their use. This issue has affected discussions in many areas of space planning, particularly European participation in post-Apollo programs. The availability of US launchers might also weaken the now strong French commitment to expansion of Western European launch capabilities.

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French Role in European Multinational Programs

In 1962, ten Western European nations plus Australia agreed upon the formation of two principal organizations to administer their mutual endeavors in space. The European Launcher Development Organization (ELDO) was set up to produce launchers for European satellites, and the European Space Research Organization (ESRO) was formed to develop satellites and to initiate programs for space research. Both began operation in 1964. ELDO was formed by six European countries and Australia. ESRO's members included the six European

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nations of ELDO plus Denmark, Spain, Sweden, and Switzerland.

This cooperative effort--plagued from the beginning by each country's insistence that it benefit more or less exactly according to the size of its contribution--has degenerated in seven years into little more than forums revealing a lack of commonly shared priorities, administrative disorientation, and poor managerial and financial control. Participation by most of the members has declined to the point where the so-called European programs are actually projects designed and executed by France and West Germany--the financial and technical supports for the two organizations.

In actuality, the so-called European programs probably do more to further France's own independent space efforts, already more advanced and comprehensive than those of all other European countries combined. At a minimum these joint space programs enable the French to realize more grandiose projects than they might reasonably undertake alone.

Prospects for an Independent Launch Capability

Any possibility that the Western European members of ELDO could agree on long-range programs for the development of an independent launch capability for Europe was dealt a crushing blow when the British announced in April 1968 that they would withdraw from ELDO when their current commitment ended in 1971. The UK reasoned that by the time ELDO's launchers became operational they would be obsolescent and uncompetitive. London asserted that further support of the program would be wasteful in view of the fact that US launchers could be purchased at reasonable prices. This decision probably also reflected the private conclusion that Britain was no longer financially capable of participating in expensive space programs.

The French continue to argue that the UK position on purchasing launchers from the US is unacceptable if Europe is to have any kind of mean-

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ingful space program. France points out that the US has never been willing to provide launchers without conditions, namely prohibitions on the use of such launch vehicles for orbiting communications satellites or for military purposes. While the French have never placed much emphasis on military space projects, the launching of a satellite communications system for Europe has been one of the space programs to which they have given top priority. The French also do not want to risk being circumscribed by conditions attached to reimbursable launchings by the US.

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France admits that the development process will take a long time and will not necessarily advance the state of the art, but believes that availability of the Europa IIIB is necessary if Europe is to be able to launch heavy communications satellites. France and, at least for the present, West Germany are prepared to continue with the Europa launch vehicle programs and hope other European countries will join later and share in the costs. There appears to be little chance, however, that Britain will participate in any European launcher development programs.

ESRO's difficulties in general have not proved so disabling as those of ELDO. In spite of limited finances, ESRO has conducted a successful space research program through sounding rockets and the development of scientific satellites, and its achievements have helped it survive sporadic threats of withdrawal.

France's strong substantive position has enabled it to force most countries involved in European space programs to either adhere to its policy preferences or abandon effective participation in the European space organizations. As a result Paris and Bonn stand alone in Europe as the only two powers willing and able to continue something resembling an independent European space effort. France's decision to establish its own independent capabilities in the field of space has both contributed to and compensated for Europe's disarray.

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Certainly, the greatest difficulties in European cooperative space programs have been political and managerial. The financial problems would not have been insuperable had the established space projects been given positive support from the national governments. But agreement in defining mutual goals has been labored, and technical questions have often been answered less on their merit than out of consideration for a "just return" on national investments.

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